U.S. Department of Energy's Office of Science

ASCR Performance Measures

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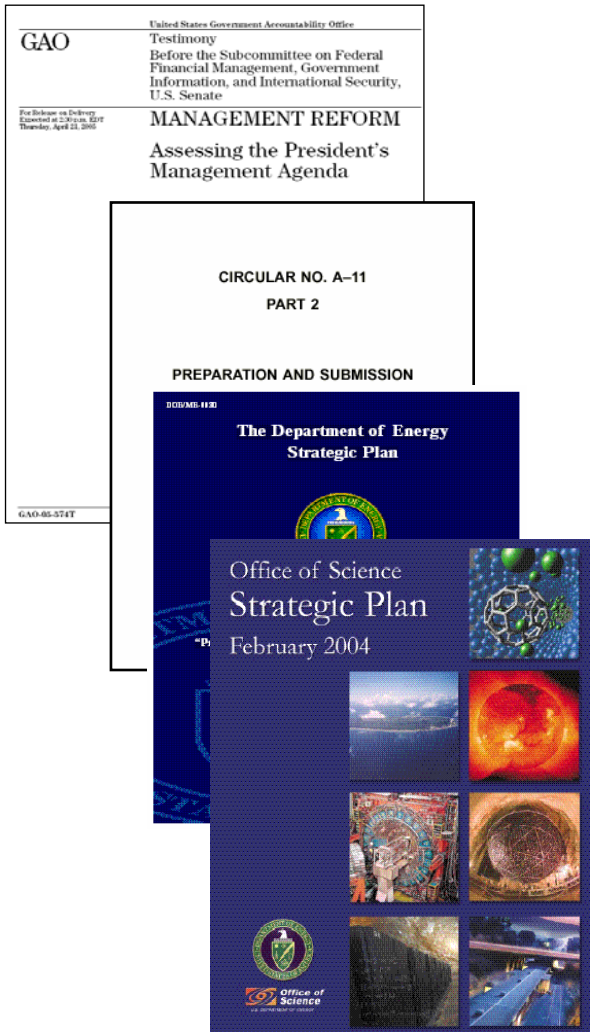
The Need for Performance Measures



- **Government Performance and Result Act (GPRA) - (1993)**
  - Requires agencies to develop a strategic plan, annual performance plan, and annual accountability report
- **OMB criteria for assessing R&D investment**
  - Requires agencies with research mission to use Performance Assessment Rating Tool (PART) to appraise for quality, relevance, and performance

PART Activities

- Activities in support of PART
  - Advisory committees
  - Committee of visitors
  - Peer-review of laboratory and university funded projects
  - Lehman reviews of major facilities
  - Strategic plans
  - Periodic external reviews of facilities and R&D programs
  - Annual progress reports for multi-year projects
  - Staff performance reviews
  - Workshops and conferences

OMB R&D Investment Criteria

- **Assessment Areas**
  - Quality – Largely determined by Independent Merit Reviews
  - Relevance – Determined by importance to a Presidential priority
  - Performance – Efficiency/effectiveness measures

- **Elements of PART**
  - Program purpose and design
  - Strategic planning
  - Program management
  - Program results

- **Performance Tracking and Reporting**
  - Quarterly performance measure reporting: **DOE Joule system**
  - Annual performance measure reporting: **OMB budget process**

Annual Performance Measures for PART

- **Capability Computing at NERSC** **(weight: 50%)**
  - Focus usage of the primary supercomputer at the NERSC on capability computing (Percentage (40%) of the computing time available at NERSC used for computations that require at least 1/8 of the total resource)

- **Computational Science Capabilities** **(weight: 50%)**
  - Improve computational science capabilities - Increase annual percentage in computational effectiveness (either by simulating the same problem in less time or simulating a larger problem in the same time)

Capability Computing Measures at NERSC

Primary NERC Supercomputer

- IMB SP (Seaborg)
- 380 Compute Nodes
- 6080 processors

- **Performance Measure Process**
  - Establish IBM SP (Seaborg) as Primary NERSC supercomputer
  - Scale system software to allow applications to use 1/8 the total processors (512 processor in FY04 and 678 processors in FY06)
  - Provide PIs with incentives to scale existing code to use large number of processors
  - Collect NERSC usage statistics

Year	# Processors	Target 1/8 of Processors	Target % of Usage	Actual % usage by1/8 Apps
2003	Base line	-	-	-
2004	4,096	512	50%	47.7%
2005	4,096	512	50%	67.5%
2006	6,080	768	40%	50.3% through Feb 2006

Capability Computing Measure at NERSC

- **Reflections on Capability Computing Measure**
  - A significant percentage of DOE science applications can use 1,000 CPUs or more and still do effective science.
  - Scaling science applications to use 1,000 or more CPUs effectively requires innovative scheduling incentives, allocation discount, and intensive consulting support.
  - High impact science applications that do not easily scale are adversely impacted by those that do.
  - DOE funded the NCSa and NCSb systems to address jobs that run at smaller scale.
  - Long running jobs may adversely impact capability measure.
  - Utilization-based metric may not adequately capture the quality and science productivity on **Seaborg.**

Computational Science Capabilities Measure

- **Performance Measure**
  - Time-to-solution

- **Performance Measure Process**
  - Identify a target set code developed by ASCR PIs and a target system on which to run the code.
  - Record performance of the target code at beginning of the fiscal year on the target system.
  - Tune/scale the code during the year using advanced coding techniques and or new mathematical algorithms developed during year.
  - Execute the new code on target system with the same configuration at the end of the fiscal year.

- **Success**
  - The annual improvement in the code, when measured in time to solution, must be 50%.

PART Benefits and Challenges

- **Benefits**
  - Encourages dialog with OMB
  - Forces evaluation of program progress and effectiveness
  - Enables programs to set higher performance goals
  - Improves program management and strategic planning

- **Challenges**
  - Quantifiable and sensible performance measures of R&D activities are difficult to define
  - Scientific discoveries are unpredictable